To Review: Gases & Kinetic Molecular Theory

- Particles_____.
- Particles have_____.
- Particles_____.
- Force of attraction between particles is _____

The Four Gas Law Variables:

Volume

•The three-dimensional space enclosed by the container walls is called_____.

•The symbol used is_____.

- Volume is usually measured in _____ or _____
-
    - The symbol for liters is _____
    - The symbol for milliliters is _____

Temperature

- All gases have a temperature, usually measured in _____
    - (the symbol = _____).
- the symbol for the temperature is,_____.

- There is another temperature scale, which is very important in gas behavior.
    - It is called the Kelvin scale (symbol =_____).
- Note that K does not have a degree sign and Kelvin is capitalized

- All gas law problems will be done with _____temperatures.
- You can convert between Celsius and Kelvin like this:

    - Kelvin = _____

- Standard temperature is defined as _____

The Kelvin temperature of a gas is directly proportional _____

Pressure

- The molecules of gas hitting the walls of the container creates _____
- There are three different units of pressure used in chemistry
  1. _____
  2. _____
  3. _____
- **Standard pressure is defined as one atm. or 760.0 mm Hg or 760 torr**.

Standard Temperature & Pressure

- Standard temperature and pressure is a very common phrase in chemistry**,**
  - Abbreviated as_____**.**
  - There is no such thing as standard _____
- STP is _____

Amount of Gas

- The amount of gas present is measured _____

  _____
- if grams are used, will need to convert to _____
- When the generalized variable of amount in moles is the letter "n" (always lower case)

Le Châtelier's Principle

If a system at equilibrium is subjected to a stress (upset), the equilibrium _____

_____

_____

_____

- This applies to gasses.

Gasses and stress

- Gasses will react very readily to changes in:
  - 1. _____
  - 2. _____

The Gas Laws

Boyle's Law

- this law gives the relationship between _____and_____, if temperature and amount are held constant.
  - If the volume of a container is increased, the pressure _____
  - If the volume of a container is decreased, the pressure_____.

- Explanation:
  - Suppose the volume is increased.
  - This means gas molecules have farther to go and they will impact the container walls less often per unit time.
  - This means the gas pressure will be less because there are less molecule impacts per unit time.

- If the volume is decreased,
  - the gas molecules have a shorter distance to go, thus striking the walls more often per unit time.
  - This results in pressure being increased because there are more molecule impacts per unit time.

- The mathematical form of Boyle's Law is:_____

- This is an _____mathematical relationship.

- This "working" equation is: _____

Charles' Law

- This law gives the relationship _____and _____if pressure and amount are held constant.
  - If the volume of a container is increased, the temperature _____
  - If the volume of a container is decreased, the temperature_____
- Explanation:
- Suppose the temperature is_____.
- This means gas molecules will move _____and they will impact the container walls more often.
- This means the gas pressure inside the container will_____ (but only for an instant..
- The greater pressure on the inside of the container walls will push them outward, thus increasing the_____.
- Charles' Law is a _____mathematical relationship.
- The mathematical form of Charles' Law is: _____
- The working equation is: _____

Gay-Lussac's Law

- Gives the relationship between_____ and _____when volume and amount are held constant.
  - If the temperature of a container is increased, the pressure _____
  - If the temperature of a container is decreased, the pressure _____
- Explanation:
  - Suppose the temperature is increased.
  - The gas molecules will move _____and impact the container walls _____often.
  - the gas pressure inside the container will _____,since the container has rigid walls (volume stays constant).

- Gay-Lussac's Law is a direct mathematical relationship.
- The mathematical form of Gay-Lussac's Law is: _____
- The working equation is:_____

Avogadro's Law

- the relationship between _____and _____when pressure and temperature are constant.
  - If the amount of gas in a container is increased, the volume_____.
  - If the amount of gas in a container is decreased, the volume_____.
- Remember amount is measured in _____
- Explanation:
  - Suppose the amount is increased.
  - This means there are _____gas molecules
  - This causes the walls to move_____.
  - This outward motion is an increase in_____
- The mathematical form of Avogadro's Law is: _____
- Avogadro's Law is a _____mathematical relationship.
- You prove Avogadro's Law: _____
- The working equation is:_____

Dalton's Law of Partial Pressures

- each gas in a mixture creates pressure as if the other gases were not present. The total pressure is the sum of the pressures created by the gases in the mixture.
  - $P_{total} = P_1 + P_2 + P_3 + ... + P_n$
    - Where n is the total number of gases in the mixture.
- The pressure each gas exerts in mixture is called its partial pressure.

Dalton's Law of Partial Pressures

- The most common use is a method of collecting gas during an experiment is by trapping it "*over water*."
- A tube from the reaction vessel conducts the gas into the bottle where it bubbles to the top and displaces water.
- However, the gas saturates with water vapor and now the total pressure inside the bottle is the sum of two pressures - the gas itself and the added water vapor.
- So we get rid of it by_____.

- The formula for determining the true gas pressure (or dry pressure) is:

  - The $P_{\text{water vapor}}$ value is found on the reference sheet according to temperature

Combined Gas Law

- The combined gas law is derived from all of the individual gas laws.
  - (Boyle, Charles, et al)

- The law looks like this:_____

- The working formula we will use is:_____

The Ideal Gas Law

- PV = nRT is another gas law that use the 4 variables and a constant
- The variables are:
  - P = _____
  - V = _____
  - n = _____
  - T = _____
  - R = is called _____
- The Numerical Value for R
  - This is a value you will need to select
  - This value is selected by _____and _____units given in the problem
  - There are many different variations
  - The four on the reference sheet are the only values we will use
- This gas can be used to determine the identity of a gas by its molar mass (molecular weight)
- This can be done by substituting _____

for n and solving for molar mass (molecular weight).

Henry's Law

- Shows the relationship between _____

  _____
- Stated: _____

  _____

  _____

- So if you increase the pressure of a gas over a liquid, _____

  _____

  _____

- The opposite occurs when you decrease the pressure over a liquid_____

  _____

  - Example: _____

- Ever opened a soda that someone has shaken?
  - What happens? _____

    _____

  - The reason: _____

    _____

- This sudden release of the gas is called_____
- That's why there is a big mess

Graham's Law

- First some terms:
  - 1. The random mixing of two gases is called _____
  - 2. The movement of gas particles (molecules or atoms) through a small hole in the container is called _____
- The law:_____

  _____

  _____

Consider samples of two different gases at the same Kelvin temperature.

- Since temperature is proportional to the kinetic energy of the gas molecules, the kinetic energy (KE) of the two gas samples is also the same.
- In equation form, we can write: $KE_1 = KE_2$

- Math wise: $$rate = \frac{1}{\sqrt{m}}$$

- Where rate is how fast the gas is escaping and *m* is the *molar mass*

- The working equation is:

$$\frac{rate1}{rate2} = \frac{\sqrt{m_2}}{\sqrt{m_1}}$$

Additional Notes: